

# Technology and Magic


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'Technological' capabilities are one of the distinguishing features of our species, and have been since a very early stage in evolution, if not from the very beginning. It is no longer possible to claim 'tool using' as an uniquely 'human' characteristic, because there are distinct tool-use traditions among apes, especially chimpanzees, and rather more rudimentary examples of tool-use among some other species as well. Human beings, however, have elaborated 'technological' means of realizing their intentions to an unprecedented degree. But what is 'technology'? and how does it articulate to the other species characteristics we possess?

The answers which have been suggested to this question have suffered from a bias arising from the misconceived notion that the obtaining of subsistence necessities from the environment is the basic problem which technology enables us to surmount. Technology is identified with 'tools' and 'tools' with artefacts, like axes and scrapers, which are presumed to have been imported in the 'food quest'. This 'food quest' has been imagined as a serious, life-or-death, business, and the employment of technology as an equally 'serious' affair. *Homo technologicus* is a rational, sensible, creature, not a mythopoeic or religious one, which he only becomes once he abandons the search for 'technical' solutions to his problems and takes off into the realms of fantasy and empty speculation.

But this opposition between the technical and the magical is without foundation. Technology is inadequately understood if it is simply identified with tool-use, and tool-use is inadequately understood if it is identified with subsistence activity.

Although it may be useful for certain classification purposes–especially in prehistory–to identify 'technology' with 'tools', from any explanatory point of view technology is much more than this. At the very minimum, technology not only consists of the artefacts which are employed as tools, but also includes the sum total of the kinds of knowledge which make possible the invention, making and use of tools. But this is not all. 'Knowledge' does not exist except in a certain social context. Technology is coterminous with the various networks of social relationships which allow for the transmission of technical knowledge, and provide the necessary conditions for cooperation between individuals in technical activity. But one cannot stop even at this point, because the objectives of technical production are themselves shaped by the social context. Technology, in the widest sense, is those forms of social relationships which make it socially necessary to produce, distribute and consume goods and services using 'technical' processes.

But what does the adjective 'technical' mean? 'Technical' does not, I think, indicate an either/or distinction between production processes which do, or do not, make use of artefacts called 'tools'. There can be 'techniques'–for instance, the 'techniques of the body' listed by Mauss–which do not make use of tools that are artefacts. What distinguishes 'technique' from non-technique is a certain degree of *circuitousness* in the achievement of any given objective. It is not so much that technique has to be learned, as that technique has to be ingenious. Techniques form a bridge, sometimes only a simple one, sometimes a very complicated one, between a set of 'given' elements (the body, some raw materials, some environmental features) and a goal-state which is to be realized making use of these givens. The given elements are rearranged in an intelligent way so that their causal properties are exploited to bring about a result which is improbable except in the light of this particular intervention.

Technical means are roundabout means of securing some desired result. The degree of technicality is proportional to the number and complexity of the steps which link the initial givens to the final goal which is to be achieved. Tools, as extensions of the body which have to be prepared before they can be used, are an important category of elements which 'intervene' between a goal and its realization. But not less 'technical' are those bodily skills which have to be acquired before a tool can be used to good effect. Some tools, such as a baseball bat, are exceptionally rudimentary, but require a prolonged (i.e. circuitous) learning-process, in appropriate learning settings, before they can be deployed to much purpose. Highly 'technical' processes combine many elements, artefacts, skills, rules of procedure, in an elaborate sequence of purposes or sub-goals, each of which must be attained in due order before the final result can be achieved. It is this elaborate structure of intervening steps, the steps which enable one to obtain result X, in order to obtain Y, in order to (finally) obtain Z, which constitute technology as a 'system'.

The pursuit of intrinsically difficult-to-obtain results by roundabout, or clever, means, is the peculiar aptitude of the technological animal, *Homo sapiens*. But it is not at all true that this propensity is displayed exclusively, or even mainly, in the context of subsistence production, or that this aptitude is unconnected with the playful and imaginative side of human nature. Indeed, to state the problem in these terms is to see immediately that there can be no possible distinction, from the standpoint of 'degree of technicality', between the pursuit of material rewards through technical activity, and the equally 'technical' pursuit of a wide variety of other goals, which are not material but symbolic or expressive. From the palaeolithic period on, human technical ability has been devoted, not just to making 'tools' such as axes and harpoons, but equally to the making of flutes, beads, statues, and much else besides, for diversion, adornment, pleasure. These objects had, without any doubt, their place in a 'sequence of purposes' which went beyond the elementary delight they afforded their makers. A flute, no less than an axe, is a tool, an element in a technical sequence; but its purpose is to control and modify human psychological responses in social settings, rather than to dismember the bodies of animals.

If a flute is properly to be seen as a tool, a psychological weapon, what is the technical system of which it forms a part? At this point I would like to offer a classificatory scheme of human technological capabilities in general, which can be seen as falling under three main headings.

The *first* of these technical systems, which can be called the 'Technology of Production', comprises tech-

nology as it has been conventionally understood, i.e. roundabout ways of securing the 'stuff' we think we need; food, shelter, clothing, manufactures of all kinds. I would include here the production of signals, i.e. communication. This is relatively uncontroversial and no more need be said about it at this point.

The *second* of these technical systems I call the 'Technology of Reproduction'. This technical system is more controversial, in that under this heading I would include most of what conventional anthropology designates by the word 'kinship'.

It must occur to anyone, nonetheless, who makes the comparison between human and animal societies, that human societies go to extreme lengths to secure specific patterns of matings and births. Once infants are born, their care and socialization is conducted in a technically elaborated way, making use of special devices such as cradles, slings, swaddling-boards, etc., and later on, toy weapons, special educational paraphernalia and institutions, and so on. The reproduction of society is the consequence of a vast amount of very skilled manipulation on the part of those with interests at stake in the process. Human beings are bred and reared under controlled conditions which are technically managed, so as to produce precisely those individuals for whom social provision has been made.

Of course, animals also engage in purposive action in order to intervene in reproductive processes, securing and defending mates, succouring their young, and so forth. Sometimes they seem to be quite cunning about it. I do not want to draw any hard and fast line between human and animal kinship here. But what I would suggest is that the really telling analogies between human and animal kinship systems are not to be found among wild populations of animal species, but among domesticated animals, such as horses and dogs, whose breeding behaviour, and social learning, human beings have learned to control using many of the same techniques as human beings use on themselves, with very much the same goals in view. We are (self-) domesticated animals; our animal analogues are the other domesticated animals.

Biologically, we possess the neotenous attributes (persistence of juvenile traits in the adult stage) which also often distinguish the domesticated variety of an animal species from its wild-type cousins (wolves vs. domesticated dogs, for instance). Domesticated varieties of animals are biddable, docile, creatures, because we have made them so. And so are we. The vaunted human attributes of teachability, flexibility–a kind of permanent childlike acceptance–are traits which have been evolved, not in the course of mighty struggles against the hostile forces of nature, but adapting to the demand for a more and more 'domesticable' human being. This is the phenotype which has been awarded maximum reproductive opportunities, and which now predominates, not because it has been 'selected' by nature, but because it selected itself.

The patterns of social arrangements which we identify as 'kinship systems' are a set of technical strategies for managing our reproductive destiny via an elaborate sequence of purposes. Accordingly, the whole domain of kinship has to be understood primarily as a technology, just as one would see horse-breeding and horse-breaking, or dog-breeding and dog-training, as 'technical' accomplishments. But how do we secure the acquiescence of horses and dogs in our intentions, apart from special breeding programmes, so as to secure a supply of tractable animals? Evidently, it is by exploiting natural biases in horse and dog psychology; in other words, by the artful use of whips, sugar-lumps, smacks, caresses, etc., all of which we can deliver because we possess hands, and know how to use them on animals all the better because we continually use them on one another.

Here we enter the domain of the *third* of our three technologies, which I will call the 'Technology of Enchantment'. Human beings entrap animals in the mesh of human purposes using an array of psychological techniques, but these are primitive by comparison with the psychological weapons which human beings use to exert control over the thoughts and actions of other human beings. The technology of enchantment is the most sophisticated that we possess.

Under this heading I place all those technical strategies, especially art, music, dances, rhetoric, gifts, etc., which human beings employ in order to secure the acquiescence of other people in their intentions or projects. These technical strategies–which are, of course, practised reciprocally–exploit innate or derived psychological biases so as to enchant the other person and cause him/her to perceive social reality in a way favourable to the social interests of the enchanter. It is widely agreed that characteristically human 'intelligence' evolved, not in response to the need to develop superior survival strategies, but in response to the complexity of human social life, which is intense, multiplex, and very fateful for the individual. Superior intelligence manifests itself in the technical strategies of enchantment, upon which the mediation of social life depends. The manipulation of desire, terror, wonder, cupidity, fantasy, vanity, an inexhaustible list of human passions, offers an equally inexhaustible field for the expression of technical ingenuity.

My present purpose is not to explore the domain of the technology of enchantment, but merely to point out that it exists, and that it has to be considered, not as a separate province, i.e. 'Art'–opposed to technology–but as a technology in itself.

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I have sketched in the scope of the idea of 'Technology'. Now I want to consider the relationship between technology–defined as the pursuit of difficult-to-obtain objectives by roundabout means–and 'magic'. Magic is, or was, clearly an aspect of each of the three technologies I have identified, i.e. the technologies of production, reproduction, and psychological manipulation, or 'enchantment'. But magic is different from these technologies, each of which involves the exploitation of the causal properties of things and the psychological dispositions of people, which are numbered, of course, among their causal properties. Whereas magic is 'symbolic'. Naturally, in stating this, I am conscious that there has been a prolonged debate about magic, and that not everybody agrees that magic is 'symbolic' at all; since it can be interpreted as an attempt to employ spirits or quasi-physical magical powers to intervene (causally) in nature. There is abundant native testimony to support this view, which is often the correct one to take from the standpoint of cultural interpretation, since nothing prevents people from holding at least some mistaken causal beliefs. However, from an observer's point of view, there is a distinction, in that efficacious technical strategies demonstrably exploit the causal properties of things in the sequence of purposes, whereas magic does not. The evolutionary survival value of the magical aspects of technical strategies is, therefore, a genuine problem.

I take the view that 'magic' as an adjunct to technical procedures persists because it serves 'symbolic' ends, that is to say, cognitive ones. Magical thought for-

malizes and codifies the structural features of technical activity, imposing on it a framework of organization which regulates each successive stage in a complex process.

If one examines a magical formula, it is often seen that a spell or a prayer does little more than identify the activity which is being engaged in and defines a criterion for 'success' in it. '*Now I am planting this garden. Let it be so productive that I will not be able to harvest all of it. Amen*'. Such a spell is meaningless by itself, and it only fulfils its technical role in the context of a magical system in which each and every gardening procedure is accompanied by a similar spell, so that the whole sequence of spells constitutes a complete cognitive plan of 'gardening'.

Magic consists of a symbolic 'commentary' on technical strategies in production, reproduction, and psychological manipulation. I suggest that magic derives from play. When children play, they provide a continuous stream of commentary on their own behaviour. This commentary frames their actions, divides it up into segments, defines momentary goals, and so on. It seems that this superimposed organizational format both guides imaginative play as it proceeds, and also provides a means of internalizing it and recalling it, as well as raw materials for subsequent exercises in innovation and recombination, using previously accumulated materials in new configurations. Not only does the basic format of children's play-commentary (now I am doing this, now I am doing that, and now this will happen...) irresistibly recall the format of spells, but the relation between reality and commentary in play and in magic-making remain essentially akin; since the play-commentary invariably idealizes the situation, going beyond the frontiers of the merely real. When a child asserts that he is an aeroplane (with arms extended, and the appropriate sound effects and swooping movements) the commentary inserts the ideal in the real, as something which can be evoked, but not realized. But the unrealizable transformation of child into aeroplane, while never actually confused with reality, does nonetheless set the ultimate goal towards which play can be oriented, and in the light of which it is intelligible and meaningful.

The same is true of magic, which sets an ideal standard, not to be approached in reality, towards which practical technical action can nonetheless be oriented.

There is another feature which play and technology share. Technology develops through a process of innovation, usually one which involves the re-combination and re-deployment of a set of existing elements or procedures towards the attainment of new objectives. Play also demonstrates innovativeness–in fact, it does so continuously, whereas innovation in technology is a slower and more difficult process. Innovation in technology does not usually arise as the result of the application of systematic thought to the task of supplying some obvious technical 'need', since there is no reason for members of any societies to feel 'needs' in addition to the ones they already know how to fulfil. Technology, however, does change, and with changes in technology, new needs come into existence. The source of this mutability, and the tendency towards ever-increasing elaboration in technology must, I think, be attributed, not to material necessity, but to the cognitive role of 'magical' ideas in providing the orienting framework within which technical activity takes place. Technical innovations occur, not as the result of attempts to supply wants, but in the course of attempts to realize technical feats heretofore considered 'magical'.

Sometimes, ethnographers record technical procedures which seem magical in themselves, even though we are assured that they are entirely practical. In the Solomon Islands, and some adjoining parts of the Pacific there used to be employed a technique of fishing using kites. This kind of fishing was done in lagoons. The fisherman would go out in a canoe, to which was fastened a kite, fashioned like a bird, but made out of pandanus leaves. From this kite, which hovered over the water, there descended a further string to which was attached a ball of spider's webs, which dangled just on the surface of the water. Fish in the lagoon would see the sparkling spider's web ball and mistake it for an insect. But when they bit into it the sticky spider's web would cause their jaws to adhere to one another, so that they could not let go. At this point the fisherman would reel in the whole contraption and take the fish.

This fishing technique exemplifies perfectly the concept of roundaboutness which I have emphasized already. But it also suggests very strongly the element of fantasy which brings technical ideas to fruition. Indeed if one encountered 'kite-fishing' as a myth, rather than as a practice, it would be perfectly susceptible to Lévi-Straussian myth-analysis. There are three elements: firstly, the spider's web, which comes from *dark places inside the earth* (caves); secondly, the kite, which is a bird *which flies in the sky*; and finally, there is the *fish which swims in the water*. These three mythemes are brought into conjunction and their contradictions are resolved in a final image, the '*fish with its jaws stuck together*' just like Asdiwal, stuck half-way up a mountain and turned to stone. One does not have to be a structuralist aficionado in order to concede that here a magical, mythopoeic, story can be realized as a 'practical' technique for catching fish.

And there are innumerable other examples which could be cited of technical strategies which, though they might or might not seem 'magical' to us, certainly do so to their practitioners. I will cite only one. In the eastern highlands of New Guinea, salt is made by burning rushes and filtering the ashes through little retorts, made of gourds, which results in briny water, which can be evaporated to produce slabs of native salt. Technically, this procedure is rather sophisticated, since it is difficult to burn the rushes at the right temperature to produce the best ash, and difficult to concentrate the brine and evaporate it with minimum wastage. Needless to say, much magic is employed, with special formulae to cover each stage of the multi-stage process, and to provide 'corrective adjustments' if the process seems to be going wrong in any way. Jadran Mimica, who provided me with these details, and whose forthcoming study of Angan salt-making is eagerly awaited as an Australian National University thesis, has brilliantly analysed the indigenous conception of the salt-making process, which, in effect, recapitulates cosmogony in terms of transformations of bodily substances, approximately in the sequence:-

*food (wood)* ⇒ *faeces (ash)* ⇒ *urine (brine)* ⇒ *milk* ⇒ *semen (evaporated brine)* ⇒ *bone/shell valuables (salt)*

It would take much too long to indicate, even in barest outline, the manifold connections between salt-making and the mythological and cosmological context within which the Angan salt makers have developed their particular expertise, and which, without a doubt, shaped it in the course of its development. The net result is that Angan salt is 'high tech' according to indigenous standards of evaluation, and has correspondingly high exchange value in local trade networks.

This leads me to one further observation on the relation between magic and technology. I have so far de-

scribed magic as an 'ideal' technology which orients practical technology and codifies technical procedures at the cognitive-symbolic level. But what would be the characteristics of an 'ideal' technology? An 'ideal' technical procedure is one which can be practiced with *zero opportunity costs*. Practical technical procedures, however efficient, always do 'cost' something, not necessarily on money terms but in terms of missed opportunities to devote time, effort and resources to alternative goals, or alternative methods of achieving the same goal. The defining feature of 'magic' as an ideal technology is that it is 'costless' in terms of the kind of drudgery, hazards and investments which actual technical activity inevitably requires. Production 'by magic' is production minus the disadvantageous side-effects, such as struggle, effort, etc.

Malinowski's *Coral Gardens and their Magic*–still the best account of any primitive technological-cum-magical system, and unlikely ever to be superseded in this respect–brings out this feature of magical thinking exceptionally well. Trobriand gardens were, no less than Angan salt-making sites, arenas in which a magical scenario was played out, in the guise of productive activity. Yam-gardens were laid out with geometrical regularity, cleared initially of the least blade of grass, and were provided with complicated constructions described as 'magical prisms' at one corner, which attracted yam-growing power into the soil. The litanies of the garden magician, delivered at the site of the magical prisms, have been recorded in their entirety by Malinowski, with detailed exegesis. They are full of metaphorical devices of sometimes considerable obscurity, but, in effect, they consist of a prolonged series of descriptions of an ideal garden, the garden to end all gardens, in which everything occurs absolutely as it should in the best of all possible worlds. The pests which inhabit the soil will rise up, and, of their own accord, commit mass suicide in the sea. Yam roots will strike down into the soil with the swiftness of a green parrot in flight, and the foliage above will dance and weave like dolphins playing in the surf.

Of course, real gardens are not quite so spectacular, though the ever-presence of these images of an ideal garden must be a major factor in focusing gardeners' minds on taking all practical steps to ensure that their gardens are better than they might otherwise be. However, if one considers the litanies of the garden magician a little more closely, one realizes that the garden being celebrated with so much fine language is, in effect, not a garden situated in some never-never land, but the garden which is actually present, which is mentioned and itemized in very minute, concrete, detail. For instance, each of the twenty-odd kinds of post or stick which is used to train yam creepers is listed, as are all the different cultigens, and all their different kinds of shoots and leaves, and so on. It is apparent that the real garden and its real productivity are what motivates the imaginary construction of the magical garden. It is because non-magical technology is effective, up to a point, that the idealized version of technology which is embodied in magical discourse is imaginatively compelling.

In other words, it is technology which sustains magic, even as magic inspires fresh technical efforts. The magical apotheosis of ideal, costless, production, is to be attained technically, because magical production is only a very flattering image of the production which is actually achievable by technical means. Hence, in practice, the pursuit of technical efficiency through intelligent effort coincides with the pursuit of the ideal of 'costless' production adumbrated in magical discourse. And this observation can lead to a conclusion concerning the fate of magic in modern societies, which no longer acknowledge magic specifically, yet are dominated by technology as never before.

What has happened to magic? It has not disappeared, but has become more diverse and difficult to identify. One form it takes, as Malinowski himself suggested, is advertising. The flattering images of commodities purveyed in advertising coincide exactly with the equally flattering images with which magic invests its objects. But just as magical thinking provides the spur to technological development, so also advertising, by inserting commodities in a mythologized universe, in which all kinds of possibilities are open, provides the inspiration for the invention of new consumer items. Advertising does not only serve to entice consumers to buy particular items; in effect, it guides the whole process of design and manufacture from start to finish, since it provides the idealized image to which the finished product must conform. Besides advertising itself, there is a wide range of imagery which provides a symbolic commentary on the processes and activities which are carried on in the technological domain. The imagination of technological culture gives rise to genres such as science fiction and idealized popular science, towards which practising scientists and technologists have frequently ambivalent feelings, but to which, consciously or unconsciously, they perforce succumb in the process of orienting themselves towards their social milieu and giving meaning to their activities. The propagandists, image-makers and ideologues of technological culture are its magicians, and if they do not lay claim to supernatural powers, it is only because technology itself has become so powerful that they have no need to do so. And if we no longer recognize magic explicitly, it is because technology and magic, for us, are one and the same.